Express Mail No. EL710236813US Docket No. 21182-7067

In The United States Patent and Trademark Office

In re Application of:		Group Art Unit:	Not Yet Assigned
Inventors:	SETH MARDER, et al.	Examiner:	Not Yet Assigned
Application No:	Not Yet Assigned	**PRELIMINARY AMENDMENT**	
Filed:	Herewith		
For:	**TWO-PHOTON OR HIGHER-ORDER ABSORBING OPTICAL MATERIALS AND METHODS OF USE**		

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Date: July 30, 2001

Caroline Ifahl

Commissioner for Patents
Washington, DC 20231

PRELIMINARY AMENDMENT

Sir:

In advance of prosecution of this newly filed divisional application, please amend the subject application as follows:

IN THE CLAIMS:

Please cancel original claims 1, 2, 8-10 and 15.

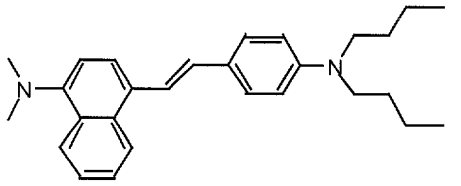
Please amend claims 3-7, 13 and 14 as follows:

3. (Amended) A method for preparing a compound in an electronically excited state, comprising the steps of:

a) exposing a compound having the formula D_1-Π-D_2 to radiation, wherein D_1 and D_2 are electron donor groups; and Π comprises a bridge of π-conjugated bonds connecting D_1 and D_2; and

b) converting said compound to a multi-photon electronically excited state upon simultaneous absorption of at least two photons of said radiation by said compound, wherein

the sum of the energies of all of said absorbed photons is greater than or equal to the transition energy from a ground state of said compound to said multi-photon excited state and wherein the energy of each absorbed photon is less than the transition energy between said ground state and the lowest single-photon excited state of said compound and is less than the transition energy between said multi-photon excited state and said ground state [A method according to claim 2], wherein said compound is selected from the group consisting of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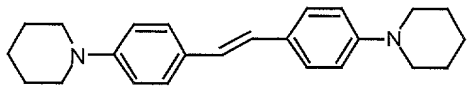
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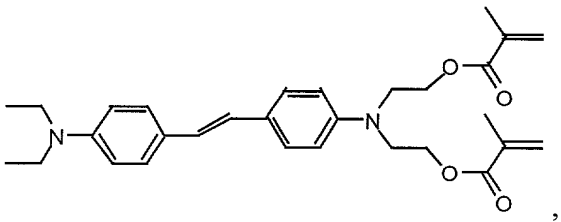
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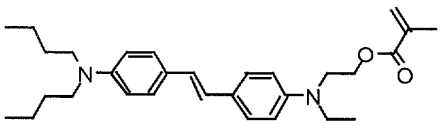
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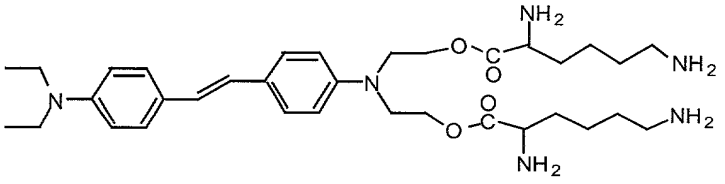
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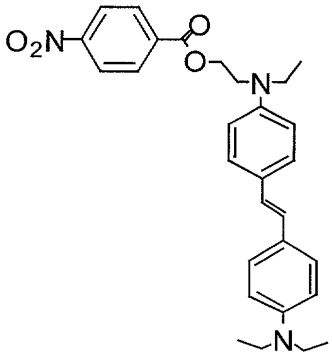
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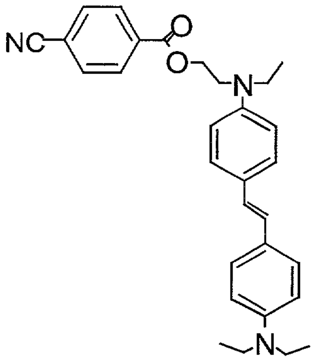
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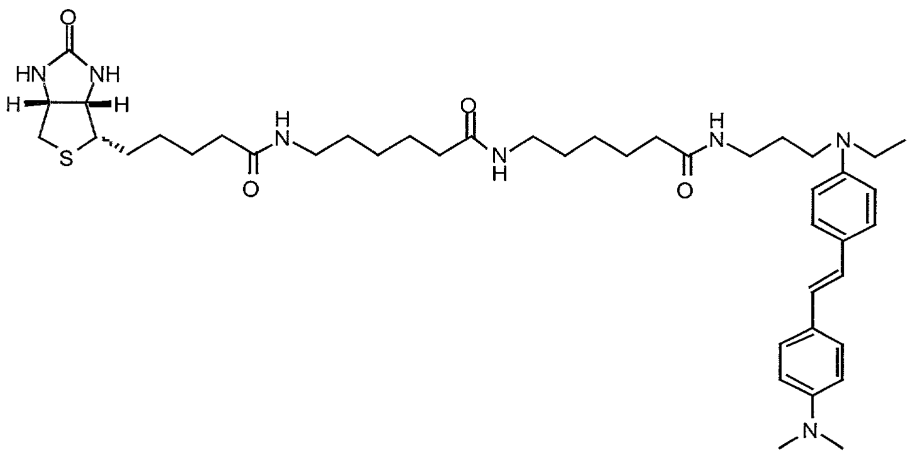
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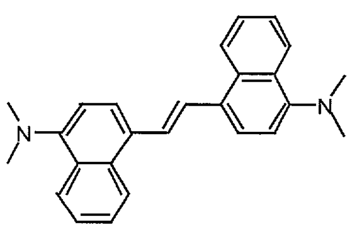
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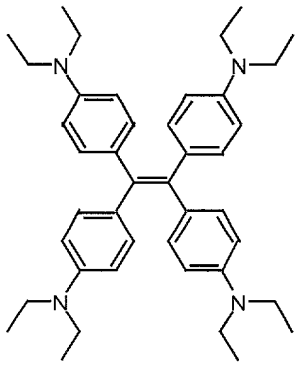
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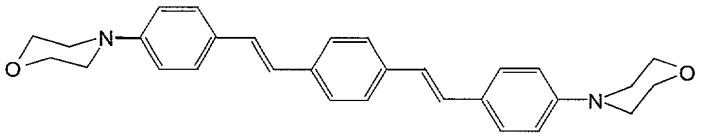
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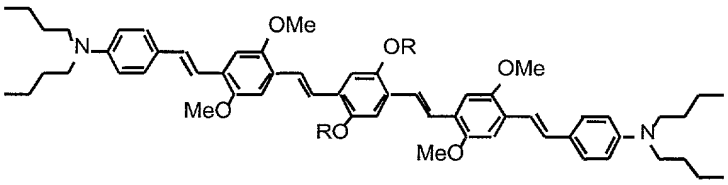

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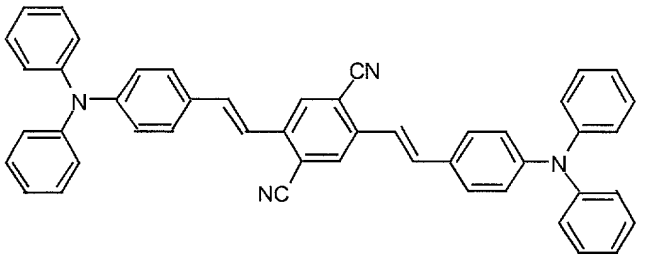

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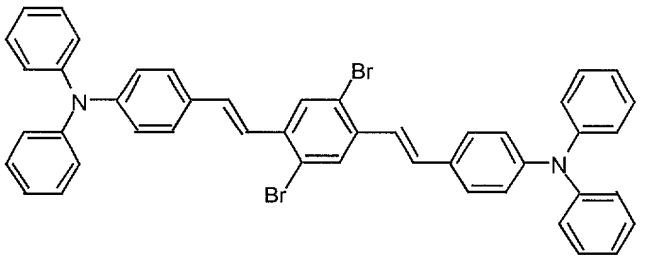

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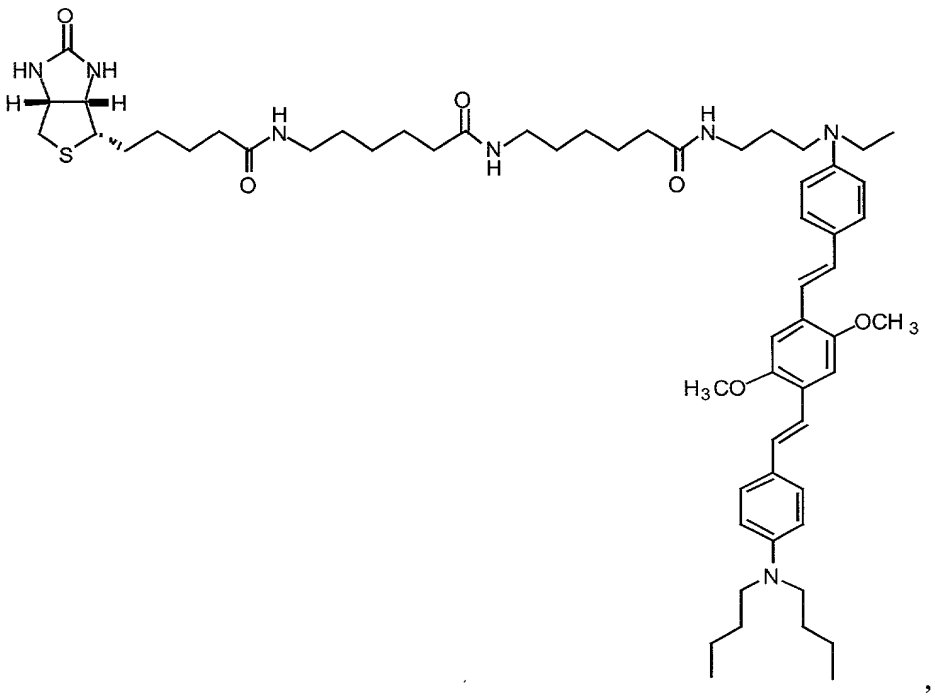
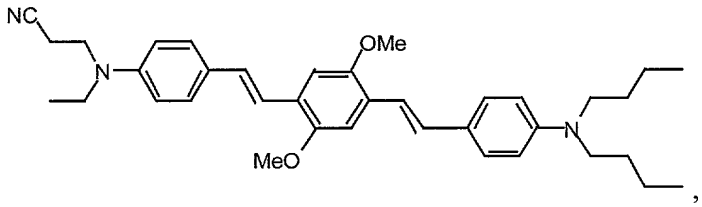
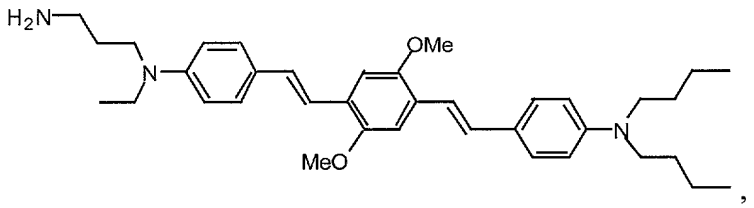






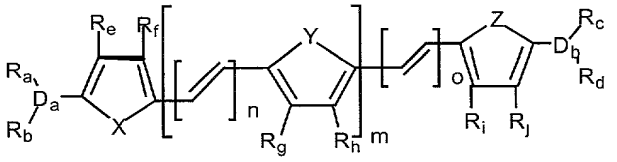
and mixtures thereof, where $R=(CH_2)_{11}CH_3$.

4. (Amended) A method for preparing a compound in an electronically excited state, comprising the steps of:

a) exposing a compound having the formula D_1-Π-D_2 to radiation, wherein D_1 and D_2 are electron donor groups; and Π comprises a bridge of π-conjugated bonds connecting D_1 and D_2; and

b) converting said compound to a multi-photon electronically excited state upon simultaneous absorption of at least two photons of said radiation by said compound, wherein the sum of the energies of all of said absorbed photons is greater than or equal to the

transition energy from a ground state of said compound to said multi-photon excited state and wherein the energy of each absorbed photon is less than the transition energy between said ground state and the lowest single-photon excited state of said compound and is less than the transition energy between said multi-photon excited state and said ground state [A method according to claim 2], wherein said compound is further defined by a formula



where D_a is selected from the group consisting of N, O, S and P;

where D_b is selected from the group consisting of N, O, S and P;

m, n, o are integers such that $0 \leq m \leq 10$, $0 \leq n \leq 10$, $0 \leq o \leq 10$; and

where:

X, Y, Z are independently selected from the group consisting of: $CR_k=CR_l$; O; S; and N-R_m;

R_a, R_b, R_c, R_d are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{a1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; where $0 < \alpha < 10$ and $1 < \beta < 25$, a group of aromatic rings having up to 20 carbons in the aromatic ring framework; fused aromatic rings, vinyl; allyl; 4-styryl; acroyl; methacroyl; acrylonitrile, isocyanate; isothiocyanate; epoxides; strained ring olefins; $(-CH_2)_\delta SiCl_3$; $(-CH_2)_\delta Si(OCH_2CH_3)_3$; and $(-CH_2)_\delta Si(OCH_3)_3$; where $\delta < 25$;

R_{a1}, R_{a2}, and R_{a3} are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons, a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof, or methacryloyl chloride;

R_e, R_f, R_g, R_h, R_i, R_j, R_k, R_l and R_m are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{b1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{b2}R_{b3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{b2}R_{b3}$, where R_{b1}, R_{b2}, and R_{b3} are independently selected

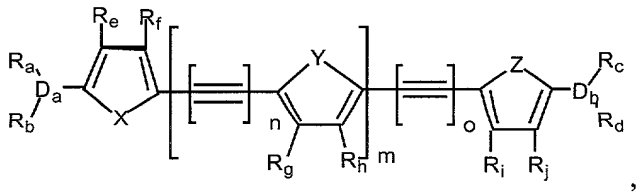
from the group consisting of a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta CN$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta Cl$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta Br$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta I$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta$-Phenyl, where $0 < \alpha < 10$ and $1 < \beta < 25$; a group of aromatic rings having up to 20 carbons in the aromatic framework; fused aromatic rings; CHO; CN; NO_2; Br; Cl; I; phenyl; an acceptor group containing more than two carbon atoms; a functional group derived from an amino acid and $NR_{e1}R_{e2}$; OR_{e3}; where R_{e1}, R_{e2}, R_{e3} are defined as for R_n and R_o, where R_n and R_o are defined as any member of the group consisting of H; a linear or branched alkyl group with up to 25 carbons; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta OR_{g1}$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta NR_{g2}R_{g3}$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta CONR_{g2}R_{g3}$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta CN$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta Cl$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta Br$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta I$; -$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta$-Phenyl; aryl groups; fused aromatic rings; polymerizable functionalities;

R_{g1}, R_{g2}, and R_{g3} are independently selected from: H; a linear or branched alkyl group with up to 25 carbons; a functional group derived from an amino acid: a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride.

5. (Amended) A method for preparing a compound in an electronically excited state, comprising the steps of:

a) exposing a compound having the formula D_1-Π-D_2 to radiation, wherein D_1 and D_2 are electron donor groups; and Π comprises a bridge of π-conjugated bonds connecting D_1 and D_2; and

b) converting said compound to a multi-photon electronically excited state upon simultaneous absorption of at least two photons of said radiation by said compound, wherein the sum of the energies of all of said absorbed photons is greater than or equal to the transition energy from a ground state of said compound to said multi-photon excited state and wherein the energy of each absorbed photon is less than the transition energy between said ground state and the lowest single-photon excited state of said compound and is less than the transition energy between said multi-photon excited state and said ground state [A method according to claim 2], wherein said compound is further defined by a formula



where D_a is selected from the group consisting of N, O, S and P;

where D_b is selected from the group consisting of N, O, S and P;

m, n, o are integers such that $0 \leq m \leq 10$, $0 \leq n \leq 10$, $0 \leq o \leq 10$; and

where:

X, Y, Z are independently selected from the group consisting of: $CR_k=CR_l$; O; S; and N-R_m;

R_a, R_b, R_c, R_d are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{a1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; where $0 < \alpha < 10$ and $1 < \beta < 25$, a group of aromatic rings having up to 20 carbons in the aromatic ring framework; fused aromatic rings, vinyl; allyl; 4-styryl; acroyl; methacroyl; acrylonitrile, isocyanate; isothiocyanate; epoxides; strained ring olefins; $(-CH_2)_\delta SiCl_3$; $(-CH_2)_\delta Si(OCH_2CH_3)_3$; and $(-CH_2)_\delta Si(OCH_3)_3$; where $\delta < 25$;

R_{a1}, R_{a2}, and R_{a3} are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons, a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof, or methacryloyl chloride;

R_e, R_f, R_g, R_h, R_i, R_j, R_k, R_l and R_m are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{b1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{b2}R_{b3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{b2}R_{b3}$, where R_{b1}, R_{b2}, and R_{b3} are independently selected from a functional group derived from an amino acid, a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl, where $0 < \alpha < 10$ and $1 < \beta < 25$; a group of aromatic rings having up to 20 carbons in the aromatic

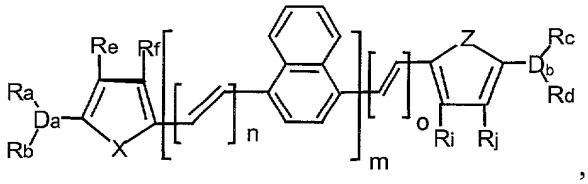
framework; fused aromatic rings; CHO; CN; NO_2; Br; Cl; I; phenyl; an acceptor group containing more than two carbon atoms; a functional group derived from an amino acid and $NR_{e1}R_{e2}$; OR_{e3}; where R_{e1}, R_{e2}, R_{e3} are defined as for R_n and R_o, where R_n and R_o are defined as any member of the group consisting of H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{g1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{g2}R_{g3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{g2}R_{g3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; aryl groups; fused aromatic rings; polymerizable functionalities;

R_{g1}, R_{g2}, and R_{g3} are independently selected from: H; a linear or branched alkyl group with up to 25 carbons; a functional group derived from an amino acid: a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride.

6. (Amended) A method for preparing a compound in an electronically excited state, comprising the steps of:

a) exposing a compound having the formula D_1-Π-D_2 to radiation, wherein D_1 and D_2 are electron donor groups; and Π comprises a bridge of π-conjugated bonds connecting D_1 and D_2; and

b) converting said compound to a multi-photon electronically excited state upon simultaneous absorption of at least two photons of said radiation by said compound, wherein the sum of the energies of all of said absorbed photons is greater than or equal to the transition energy from a ground state of said compound to said multi-photon excited state and wherein the energy of each absorbed photon is less than the transition energy between said ground state and the lowest single-photon excited state of said compound and is less than the transition energy between said multi-photon excited state and said ground state [A method according to claim 2], wherein said compound is further defined by a formula



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where D_a is selected from the group consisting of N, O, S and P;

where D_b is selected from the group consisting of N, O, S and P;

m, n, o are integers such that $0 \leq m \leq 10$, $0 \leq n \leq 10$, $0 \leq o \leq 10$; and

where:

X, Y, Z are independently selected from the group consisting of: $CR_k=CR_l$; O; S; and N-R_m;

R_a, R_b, R_c, R_d are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{a1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; where $0 < \forall < 10$ and $1 < \exists < 25$, a group of aromatic rings having up to 20 carbons in the aromatic ring framework; fused aromatic rings, vinyl; allyl; 4-styryl; acroyl; methacroyl; acrylonitrile, isocyanate; isothiocyanate; epoxides; strained ring olefins; $(-CH_2)_\delta SiCl_3$; $(-CH_2)_\delta Si(OCH_2CH_3)_3$; and $(-CH_2)_\delta Si(OCH_3)_3$; where $\delta < 25$;

R_{a1}, R_{a2}, and R_{a3} are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons, a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof, or methacryloyl chloride;

R_e, R_f, R_i, R_j, R_k, R_l and R_m are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{b1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{b2}R_{b3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{b2}R_{b3}$, where R_{b1}, R_{b2}, and R_{b3} are independently selected from a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl, where $0 < \forall < 10$ and $1 < \exists < 25$; a group of aromatic rings having up to 20 carbons in the aromatic framework; fused aromatic rings; CHO; CN; NO_2; Br; Cl; I; phenyl; an acceptor group containing more than two carbon atoms; a functional group derived from an amino acid and $NR_{e1}R_{e2}$; OR_{e3}; where R_{e1}, R_{e2}, R_{e3} are defined as for R_n and R_o, where R_n and R_o are defined as any member of the group consisting of H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{g1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{g2}R_{g3}$;

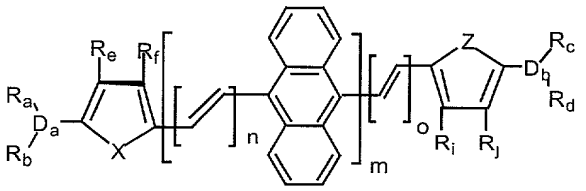
$-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{g2}R_{g3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; aryl groups; fused aromatic rings; polymerizable functionalities;

R_{g1}, R_{g2}, and R_{g3} are independently selected from: H; a linear or branched alkyl group with up to 25 carbons; a functional group derived from an amino acid: a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride.

7. (Amended) A method for preparing a compound in an electronically excited state, comprising the steps of:

a) exposing a compound having the formula D_1-Π-D_2 to radiation, wherein D_1 and D_2 are electron donor groups; and Π comprises a bridge of π-conjugated bonds connecting D_1 and D_2; and

b) converting said compound to a multi-photon electronically excited state upon simultaneous absorption of at least two photons of said radiation by said compound, wherein the sum of the energies of all of said absorbed photons is greater than or equal to the transition energy from a ground state of said compound to said multi-photon excited state and wherein the energy of each absorbed photon is less than the transition energy between said ground state and the lowest single-photon excited state of said compound and is less than the transition energy between said multi-photon excited state and said ground state [A method according to claim 2], wherein said compound is further defined by a formula



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where D_a is selected from the group consisting of N, O, S and P;

where D_b is selected from the group consisting of N, O, S and P;

m, n, o are integers such that $0 \leq m \leq 10$, $0 \leq n \leq 10$, $0 \leq o \leq 10$; and

where:

X, Y, Z are independently selected from the group consisting of: $CR_k=CR_l$; O; S; and N-R_m;

R_a, R_b, R_c, R_d are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{a1}$;

$-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; where $0 < \forall < 10$ and $1 < \exists < 25$, a group of aromatic rings having up to 20 carbons in the aromatic ring framework; fused aromatic rings, vinyl; allyl; 4-styryl; acroyl; methacroyl; acrylonitrile, isocyanate; isothiocyanate; epoxides; strained ring olefins; $(-CH_2)_\delta SiCl_3$; $(-CH_2)_\delta Si(OCH_2CH_3)_3$; and $(-CH_2)_\delta Si(OCH_3)_3$; where $\delta < 25$;

R_{a1}, R_{a2}, and R_{a3} are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons, a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof, or methacryloyl chloride;

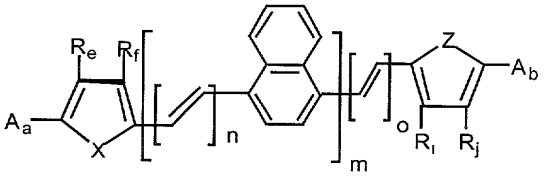
R_e, R_f, R_i, R_j, R_k, R_l and R_m are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{b1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{b2}R_{b3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{b2}R_{b3}$, where R_{b1}, R_{b2}, and R_{b3} are independently selected from the group consisting of a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl, where $0 < \alpha < 10$ and $1 < \beta < 25$; a group of aromatic rings having up to 20 carbons in the aromatic framework; fused aromatic rings; CHO; CN; NO_2; Br; Cl; I; phenyl; an acceptor group containing more than two carbon atoms; a functional group derived from an amino acid and $NR_{e1}R_{e2}$; OR_{e3}; where R_{e1}, R_{e2}, R_{e3} are defined as for R_n and R_o, where R_n and R_o are defined as any member of the group consisting of H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{g1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{g2}R_{g3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{g2}R_{g3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; aryl groups; fused aromatic ring; polymerizable functionalities;

R_{g1}, R_{g2}, and R_{g3} are independently selected from: H; a linear or branched alkyl group with up to 25 carbons; a functional group derived from an amino acid: a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride.

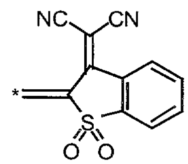
13. (Amended) A method for preparing a compound in an electronically excited state, comprising the steps of:

a) exposing a compound having the formula A_1-Π-A_2 to radiation, wherein A_1 and A_2 are electron acceptors; and Π comprises a bridge of π-conjugated bonds connecting A_1 and A_2; and

b) converting said compound to a multi-photon electronically excited state upon simultaneous absorption of at least two photons of said radiation by said compound, wherein the sum of the energies of all of said absorbed photons is greater than or equal to the transition energy from a ground state of said compound to said multi-photon excited state and wherein the energy of each absorbed photon is less than the transition energy between said ground state and the lowest single-photon excited state of said compound and is less than the transition energy between said multi-photon excited state and said ground state [A method according to claim 9], wherein said compound is further defined by a formula



where A_a and A_b can be independently selected from: CHO; CN; NO_2, and



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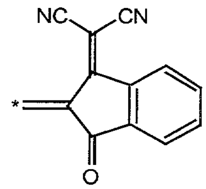

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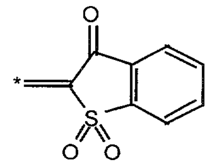

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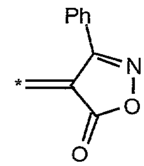

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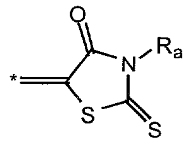

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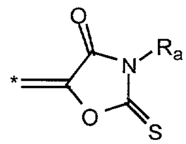

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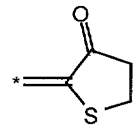

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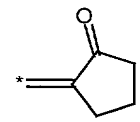

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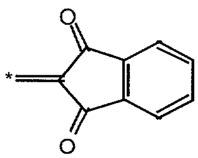

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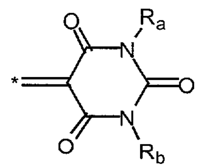

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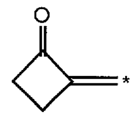

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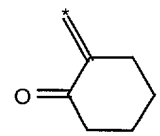

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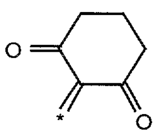

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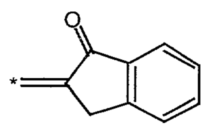

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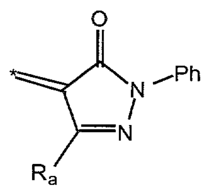

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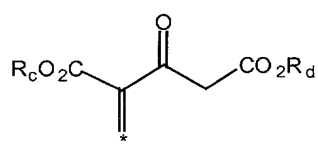

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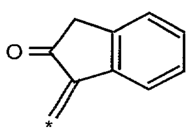

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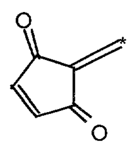

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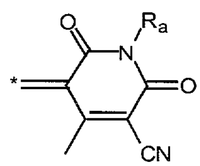

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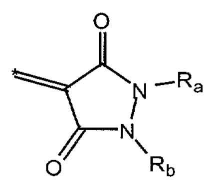

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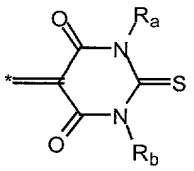

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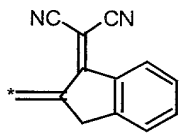

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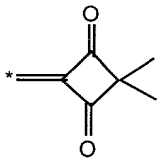

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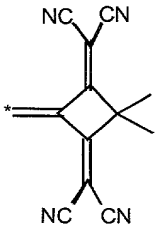

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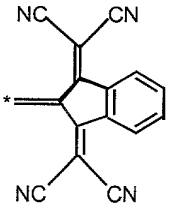

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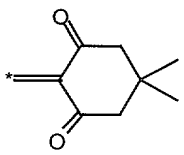

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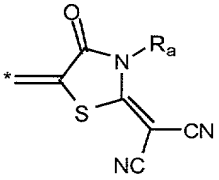

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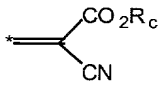

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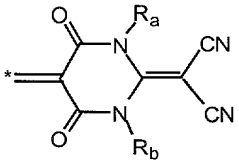

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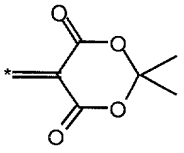

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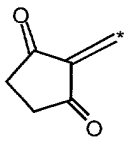

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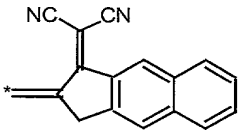

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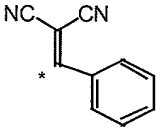

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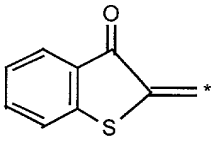

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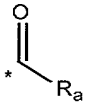

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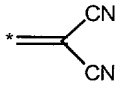

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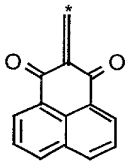

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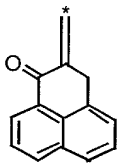

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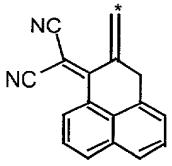

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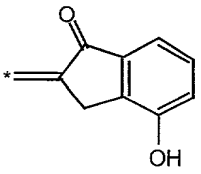

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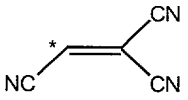

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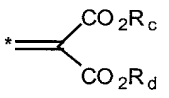


A42

in addition A_a and A_b can be independently selected from Br, Cl, and I; and where $0 \leq m \leq 10$, $0 \leq n \leq 10$, $0 \leq o \leq 10$.

; and where:

X, Y, Z are independently selected from the group consisting of: $CR_k=CR_l$; O; S; and N-R_m;

R_a, R_b, R_c, R_d are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{a1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; where $0 < \alpha < 10$ and $1 < \beta < 25$, a group of aromatic rings having up to 20 carbons in the aromatic ring framework; fused aromatic rings, vinyl; allyl; 4-styryl; acroyl; methacroyl; acrylonitrile, isocyanate; isothiocyanate; epoxides; strained ring olefins; $(-CH_2)_\delta SiCl_3$; $(-CH_2)_\delta Si(OCH_2CH_3)_3$; and $(-CH_2)_\delta Si(OCH_3)_3$; where $\delta < 25$;

R_{a1}, R_{a2}, and R_{a3} are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons, a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof, or methacryloyl chloride;

R_e, R_f, R_i, R_j, R_k, R_l and R_m are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{b1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{b2}R_{b3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{b2}R_{b3}$, where R_{b1}, R_{b2}, and R_{b3} are independently selected from the group consisting of a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl, where $0 < \forall < 10$ and $1 < \exists < 25$; a group of aromatic rings having up to 20 carbons in the aromatic framework; fused aromatic rings; CHO; CN; NO_2; Br; Cl; I; phenyl; an acceptor group containing more than two carbon atoms; a functional group derived from an amino acid and $NR_{e1}R_{e2}$; OR_{e3}; where R_{e1}, R_{e2}, R_{e3} are defined as for R_n and R_o, where R_n and R_o are defined as any member of the group consisting of H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{g1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{g2}R_{g3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{g2}R_{g3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$;

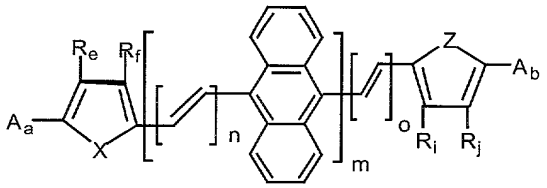
$-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; aryl groups; fused aromatic rings; polymerizable functionalities;

R_{g1}, R_{g2}, and R_{g3} are independently selected from: H; a linear or branched alkyl group with up to 25 carbons; a functional group derived from an amino acid; or a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride.

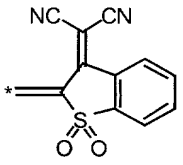
14. (Amended) A method for preparing a compound in an electronically excited state, comprising the steps of:

a) exposing a compound having the formula A_1-Π-A_2 to radiation, wherein A_1 and A_2 are electron acceptors; and Π comprises a bridge of π-conjugated bonds connecting A_1 and A_2; and

b) converting said compound to a multi-photon electronically excited state upon simultaneous absorption of at least two photons of said radiation by said compound, wherein the sum of the energies of all of said absorbed photons is greater than or equal to the transition energy from a ground state of said compound to said multi-photon excited state and wherein the energy of each absorbed photon is less than the transition energy between said ground state and the lowest single-photon excited state of said compound and is less than the transition energy between said multi-photon excited state and said ground state [A method according to claim 9], wherein said compound is further defined by a formula



where A_a and A_b can be independently selected from: CHO; CN; NO_2, and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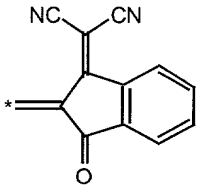
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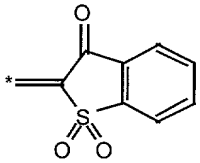
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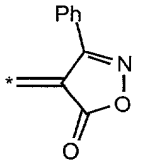
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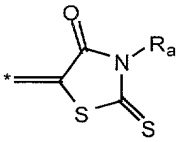
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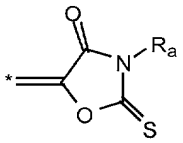
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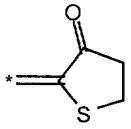
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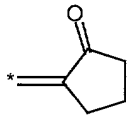
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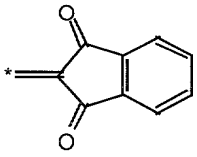
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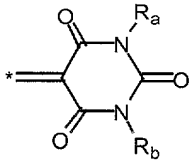
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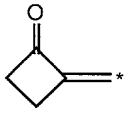
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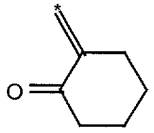
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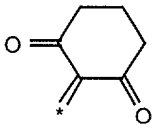
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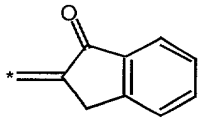
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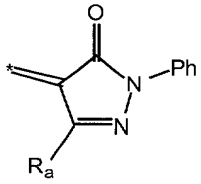
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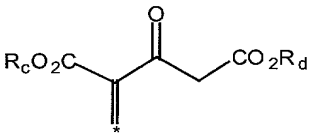
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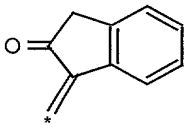
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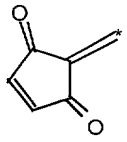
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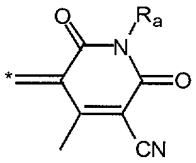
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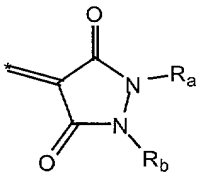
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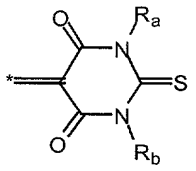
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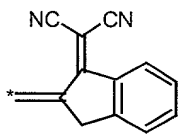
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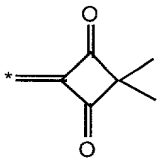
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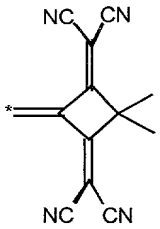
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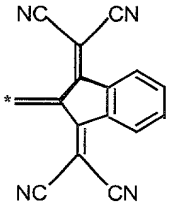
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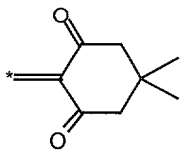
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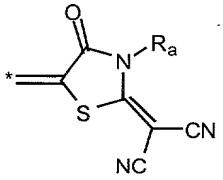
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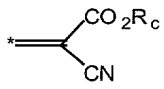
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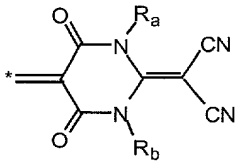
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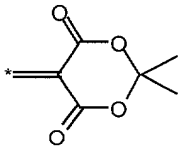
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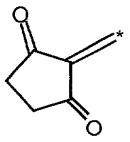
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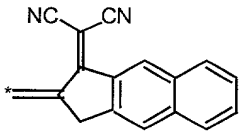
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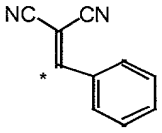
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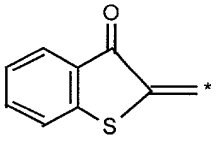
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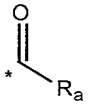
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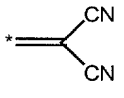
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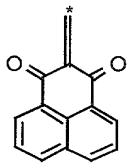
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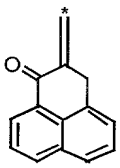
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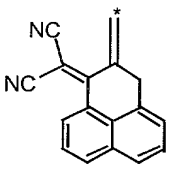
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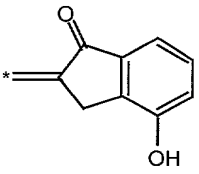
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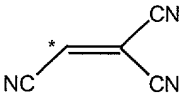
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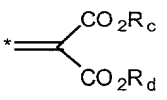
A42

in addition A_a and A_b can be independently selected from Br, Cl, and I; and where $0 \leq m \leq 10$, $0 \leq n \leq 10$, $0 \leq o \leq 10$.

; and where:

X, Y, Z are independently selected from the group consisting of: $CR_k=CR_l$; O; S; and N-R_m;

R_a, R_b, R_c, R_d are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{a1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{a2}R_{a3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; where $0 < \forall < 10$ and $1 < \exists < 25$, a group of aromatic rings having up to 20 carbons in the aromatic ring framework; fused aromatic rings, vinyl; allyl; 4-styryl; acroyl; methacroyl; acrylonitrile, isocyanate; isothiocyanate; epoxides; strained ring olefins; $(-CH_2)_\delta SiCl_3$; $(-CH_2)_\delta Si(OCH_2CH_3)_3$; and $(-CH_2)_\delta Si(OCH_3)_3$; where $\delta < 25$;

R_{a1}, R_{a2}, and R_{a3} are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons, a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof, or methacryloyl chloride;

R_e, R_f, R_i, R_j, R_k, R_l and R_m are independently selected from the group consisting of: H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{b1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{b2}R_{b3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{b2}R_{b3}$, where R_{b1}, R_{b2}, and R_{b3} are independently selected from the group consisting of a functional group derived from an amino acid; a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl, where $0 < \forall < 10$ and $1 < \exists < 25$; a group of aromatic rings having up to 20 carbons in the aromatic framework; fused aromatic rings; CHO; CN; NO_2; Br; Cl; I; phenyl; an acceptor group containing more than two carbon atoms; a functional group derived from an amino acid and $NR_{e1}R_{e2}$; OR_{e3}; where R_{e1}, R_{e2}, R_{e3} are defined as for R_n and R_o, where R_n and R_o are defined as any member of the group consisting of H; a linear or branched alkyl group with up to 25 carbons; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta OR_{g1}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta NR_{g2}R_{g3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CONR_{g2}R_{g3}$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta CN$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta Cl$;

$-(CH_2CH_2O)_\alpha-(CH_2)_\beta Br$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta I$; $-(CH_2CH_2O)_\alpha-(CH_2)_\beta$-Phenyl; aryl groups; fused aromatic rings; polymerizable functionalities;

R_{g1}, R_{g2}, and R_{g3} are independently selected from: H; a linear or branched alkyl group with up to 25 carbons; a functional group derived from an amino acid; or a polypeptide; adenine; guanine; tyrosine; cytosine; uracil; biotin; ferrocene, ruthenocene, cyanuric chloride and derivatives thereof or methacryloyl chloride.

IN THE SPECIFICATION:

Please amend the specification as follows:

Page 1, line 16, after "This application" please insert –is a divisional application of U.S. Application No. 08/965,945, filed November 7, 1997, now U.S. Patent No. 6,267,913 and--.

Page 7, line 1, please insert --*indicates the point of attachment to the π-conjugated bridge.--.

Page 9, line 13, please insert –a molecular fragment—after "molecule".

Page 9, line 27, delete "of" and insert –or--.

Page 10, line 25, delete "That is, subsequent" and replace with –Subsequent--.

Page 11, line 3 please insert –stilbene, diphenylpolyene, phenylene vinylene oligomers, and related—before "molecules".

Page 11, line 7, please insert –unsubstituted—before "stilbene".

Page 11, line 8, please insert –respectively—after "molecules".

Page 11, line 29, please delete "placing" and replace with –the occurrence of--.

Page12, line 7, please delete "placing" and replace with –the occurrence of--.

Page 12, line 16, please insert –fluorescent—before "emitters".

Page 14, line 22, please insert –two-dimensional or three-dimensional—after "multi-photon".

Page 15, line 25, please delete "a "before" multi-photon absorbing dye" and replace with –the--.

Page 16, line 6, please delete "a "before" multi-photon absorbing dye" and replace with –the--.

Page 16, line 21, please delete "In addition," and replace with –Additional--.

Page 18, line 11, please insert –organic and aqueous-- before "solution".

Page 20, line 8, please insert –and d_{1/e^2} is the full width of the beam where the intensity is $1/e^2$ times the peak intensity— after "where".

Page 21, line 19, please insert --,-- after "group".

Page 22, line 1, please insert --,-- after "group".

Page 22, line 4, please delete "Ri" and replace with –R_i--.

Page 22, line 9, please insert ---$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta CO_2R_{\alpha 1}$; —after "carbons;".

Page 22, line 14, please insert –attached through a linkage which can be chosen from a linear or branched alkyl chain with up to 25 carbons, various aryl groups, $(CH_2CH_2O)_\alpha$-$CH_2)_\beta$-, and –$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta CO_2$.-- after "functionalities".

Page 24, line 19, please insert ---$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta CO_2R_{a1}$—after "carbons;".

Page 24, line 26, delete "as defined" and replace with –defined as--.

Page 27, line 6, please insert ---$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta CO_2R_{a1}$—after "carbons;".

Page 31, line 8, please insert ---$(CH_2CH_2O)_\alpha$-$(CH_2)_\beta CO_2R_{a1}$—after "carbons;".

Page 32, line 4, please insert –properties—after "absorption".

Page 33, line 6, please delete "In addition, the" and replace with –The--.

Page 33, line 7, please insert –to effect the multiphoton absorption—after "radiation".

Page 54, line 10, please delete "of" after "remove".

Page 70, line 12, after "11.8%", please insert --;--.

Page 73, line 1, after "N, N-dimethylformamide/water", please insert --.--.

Page 76, line 1, before "hydrobromic", please insert --to--.

Page 76, line 25, after "cis", please replace "ans" with --and--.

Page 79, line 17, after "yield", please replace 1,4-bis(β-cyano-4'diphenyl-aminostyryl)benzene" with –1,4-bis(β-cyano-4'-diphenylaminostyryl)benzene--.

Page 90, line 4, please delete "69" and insert –55--.

Page 91, line 9, please insert –effective—before "two-photon".

Page 91, line 10, please insert –larger—before "than".

Page 91, line 12, please insert –Effective—before "Two-photon" and please delete "Two" and insert –two--.

Page 98, line 7, please delete "for example" and replace with --and--.

Page 110, line 10, please delete "in situ" and replace with --in vivo--.

Page 116, line 1, please insert --.-- after "pulses".

Page 116, line 6, please replace "Secondly," with --Thirdly,--.

Page 119, lines 11-12, after "with", please replace "1-(di-4-n-butylaminophenyl)-10-(4-dimethylaminophenyl)deca 1,3,5,7,9-pentaene" with --1-(di-4-n-butylaminophenyl)-10-(4-dimethylaminophenyl)-deca-1,3,5,7,9-pentane--.

Page 116, line 18 , please insert –By "mesoscopic phases," we refer to materials with structural order on a length scale between that of individual molecules, i.e., above about 10 Angstroms, and the microscopic length scale, i.e., above about one micrometer. These materials include small molecule and polymeric liquid crystals, colloidal, micellar and liposomal suspensions, self assembled nanoparticle arrays, and the like.— after "gases."

IN THE ABSTRACT:

Please amend the application to include an abstract as follows:

--ABSTRACT

Compositions capable of simultaneous two-photon absorption and higher order absorptivities are disclosed. Many of these compositions are compounds satisfying the formulae d-A-D, A-A-A, D-A-D and A-D-A, wherein D is an electron donor group, A is an electron acceptor group and A comprises a bridge of B-conjugated bonds connecting the electron donor groups and electron acceptor groups. In A-D-A and D-A-D compounds, the B bridge is substituted with electron donor groups and electron acceptor groups. Also disclosed are methods that generate an electronically excited state of a compound, including those satisfying one of these formulae. The electronically excited state is achieved in a method that includes irradiating the compound with light. Then, the compound is converted to a multi-photon electronically excited state upon simultaneous absorption of at least two photons of light. The sum of the energies of all of the absorbed photons is greater than or equal to the transition energy from a ground state of the compound to the multi-photon excited state. The energy of each absorbed photon is less than the transition energy between the round state and the lowest single-photon excited state of the compound is less than the transition energy between the multi-photon excited state and the ground state.--

REMARKS

Original claims 1, 2, 8-10 and 15 have been cancelled. Claims 3-7, 13 and 14 are pending. Amended claims 3-7, 13 and 14 have been rewritten to be in independent form by including the limitations of the original independent claims from which claims 3-7, 13 and 14 depended. No new matter has been added.

The specification has been amended throughout to clarify the disclosure and improve readability. In addition, the specification has been amended to cross-reference its parent application. No new matter has been added.

The subject application has been amended to add an abstract. The specification as a whole supports the abstract; no new matter has been added.

A substitute specification and clean version of the claims reflecting these amendments accompany this Preliminary Amendment.

CONCLUSION

In view of the above-made amendments and remarks, Applicants respectfully request an early action on the merits. In the event that a telephonic interview would be helpful for advancing the prosecution, the Examiner is invited to contact the undersigned at (415) 393-2168.

Date:

Respectfully submitted,

By: _____
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